SUPPORTING INDUSTRIES

Project Fact Sheet

An Integrated Heat Treatment Model for Aluminum Castings

Benefits

Compared to the current technology specifying heat treatment cycle and furnace loadings based on prior specifications and historical “rules of thumb”, the use of IHTS is expected to result in:

- 50% to 80% reduction in solutioninzing heat treatment times, leading to reductions of 25% to 50% in cycle time and energy consumption; and
- 50% indirect reduction in non-energy environmental impacts and variable costs

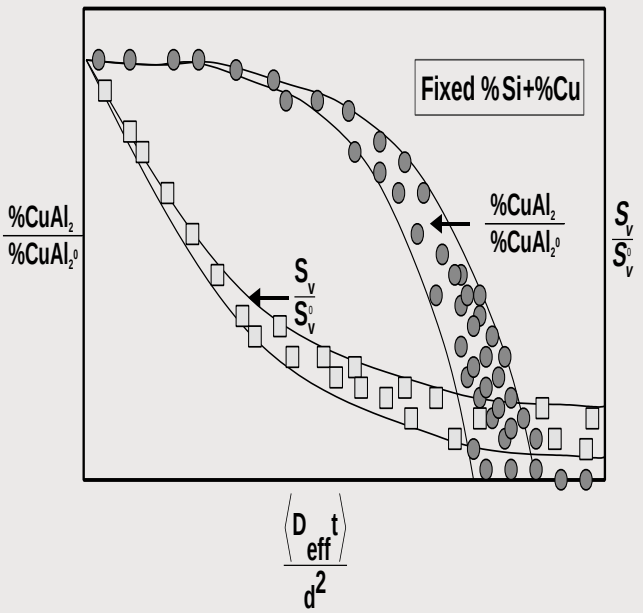
Applications

The research program will extend understanding of the evolution of microstructure during the heat treatment of complex, multi-component alloys and will develop quantitative relations among process, microstructure, and properties applied to aluminum castings. The methodology developed will serve as a framework to develop quantitative process models for other alloy systems, including ferrous alloys.

A heat treatment model to achieve specified microstructures and mechanical properties, in the critical sections of aluminum alloy castings

In this project, an integrated process model will be developed and verified, which will be translated into computer modules for optimizing the thermal cycle and achieving the specified microstructures and mechanical properties in the critical sections of aluminum alloy castings. Alternatively, the model will be used to design alloys that are more responsive to heat treatment and less costly to produce. As these modules are developed, their utility will be tested and demonstrated by applying them to develop such improved alloys, and more energy efficient thermal cycles that will increase productivity. The modules developed will be transferred to industry to be integrated with commercial casting process simulation and design software packages. The product from this project will be the Integrated Heat Treatment Software (IHTS) with an expected license life of one year including the annual upgrades and maintenance of the databases and the software.

Process Microstructure Design



Process Microstructure Map

319 Al Alloy - As Cast

Illustration of database being developed to characterize the effect of casting and heat treatment process parameters on the evolution of microstructure in aluminum casting alloy 319.

Project Description

Goal: The objectives of this research are:

- The use of dendrite arm spacing (DAS) and other microstructural features as an input to the heat transfer and solutionizing software models and databases, and determine the process parameters to soultionize the particular as-cast alloy.
- The preferred use of IHTS to replace the current and long used process parameter specifications which are based on “rules of thumb” and are for the old, non-modified casting microstructures with large DAS.

The IHTS developed in this project will be used to determine and optimize solutionizing heat treatment process parameters for cast aluminum alloys. The IHTS will first determine the microstructure of the as-cast alloy, particularly the DAS as a function of casting parameters.

Progress and Milestones

- Project start date, September 2001.
- Project end date, August 2005.
- The IHTS will be developed and tested over four years starting the year 2001.
- The first commercial introduction will be within one year after the end of this project in the year 2006.
- The time to market saturation including both large and small foundries is expected to be ten years.

Commercialization Plans

To be determined.

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